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THE AMERICAN

Meteorological Journal

VOL. II. DETROIT, AUGUST, 1885. NO. 4.

CURRENT NOTES.

AUGUST PREDICTIONS.—The comments of the editor of THE JOURNAL in the July number on the question of long period forecasts of the weather warrant me in again calling attention to the fact that my efforts in that direction are largely tentative, and that if the elements really exist for accurate and detailed long time forecasts, much more extensive daily reports must be secured than are now furnished by the Signal Service, extending especially far north and west into British territory, and much more careful study and comparison must be made than I am able to give the subject. Everything so far the present season, according to my observation, has tended to confirm the theory that the marking point and chief cause of the slow eastward movements of weather areas must be looked for at the line where the warm winds from the Pacific meet the billows of arctic atmosphere that roll southward, and this point during the summer season is far north of any signal station from which dispatches are received. Perhaps in his cycle theory Mr. Clayton has discovered the billowy impulse given to the warmer southern atmosphere by this conflict between the hot and cold winds.

In my predictions for July, while not undertaking detailed forecasts like those of Mr. Clayton, I said that I was unable to discover anything in the situation likely to cause any special departure from the normal, either in temperature or rainfall, and everything promised generally favorable weather for crops and harvest. The fact, I think, has fully verified the forecast. For August my prediction is similar. I think we shall have about the average rainfall, which is not large, and mostly local showers, and that there will be the usual cold period toward the latter part of the month.

LOREN A. SHERMAN.

Mr. Clayton's Prediction.—The area of abnormal warmth which the maps accompanying my last article showed had existed in the west since February, after being retarded in its eastward movement for a month or two, seems at last to have covered the eastern portion of the United States; but my data are too meagre to allow me to form any conclusion as to its duration.

It is probable that the average pressure over the eastern half of the United States for the month of August will be lower, and rainfall greater than that of July.

It is probable that the average pressure of the first ten days will be lower than both that of the ten days which followed the middle of July and of the ten days which will follow the middle of August. On one or two of these days the pressure will probably be quite low with heavy rainfalls in some sections.

The temperature depends almost entirely on the position of the center of lowest pressure, and my data is insufficient to allow me to form more than a conjecture as to the position of this; but some of the indications seem to point toward the conclusion that August will not be on the whole an abnormally hot month.

THE BILL to increase the usefulness of the Michigan weather service, to which we referred in a preceding number, (April, 1, 503), has failed to pass the House of Representatives. It received 43 yeas to 17 nays, and evidently had many friends, but as a majority of all members of the house failed to vote for it, it did not become law.

RAIN AND SNOW GAUGE OF THE PRUSSIAN ROYAL METEOROLOGICAL INSTITUTE.—A new form has been recently introduced, devised by Dr. Hellmann. The gauge is cylindrical, with a conical base and outflow at the base with a stopcock, of which the observer carries the key. In the gauge and near the bottom is placed a funnel, separating the gauge into the catching part above and the receiver below, the latter being thus protected from evaporation. The gauge is attached to a staff at an elevation of 45 centimeters (17.7 inches) above the ground. The especial recommendation of this form is, that, while it is accurate, and convenient, it is also cheap.

ICE STUDIES.—Messrs. Trowbridge and McRae have published in the May number of the *American Journal of Science* some interesting studies on the physical properties of ice. A cylinder of ice suspended by one end gradually took on the form of the frustum of a cone. The modulus of elasticity varied much with the individual pieces of ice but was always larger than that obtained by Bevan in 1826, apparently the only preceding experiments. Sound travels in ice at the rate of 2,900 metres (9,515 feet) per second, about nine times as fast as in the air. In the same number of the *Journal* Mr. W. J. McGee finds that the five geologic glaciers flowing into Mono Lake on the western side, tended to a northward deflection, and, from a study of the principles involved, he comes to the conclusion that "ice-streams flowing upon plains are deflected toward the sides upon which affective solar accession is least."

EARTH'S ROTATION AND RAILROADS.—We clip the following from the notes and queries of the *Scientific American*. "F. A. M. writes: I have charge of 6 miles of track on a north and south road, and I find that 90 per cent. of the iron worn out is on the west side of track. Can you assign the reason for wearing a greater per cent. on the west side than on the east? A. Your observation is a very curious one, and if this fact could be proved universally on north and south roads, would stand as a very pretty practical demonstration of the rotation of our earth. The wear you speak of must be due to the uneven loading of your freight cars or to the fact that the rotation of earth on its axis from west to east throws the greater weight of the cars on the west track, causing a greater wear

of same. Mr. P. H. Dudley of the dynograph car, and who has examined the principal railroads in this country, informs us that he has not discovered that under normal and equal conditions the wear of west rails in north and south roads is greater than that of east rails. Further facts in this matter would be of interest."

RAIN WARNINGS.—"Beginning May 1, 1885, the Blue Hill Meteorological Observatory will attempt to give warning of rain. A square red flag displayed during the day and a red lantern shown by night, at the Observatory on Blue Hill, will indicate that rain is expected in the vicinity within twelve hours from the first display of these signals. The display of the black and white cold wave flag, as ordered by the United States Signal Service, will be continued. As the rain warnings are an experiment of the undersigned, they will be discontinued if unsuccessful.

A. LAWRENCE ROTCH,
Blue Hill Meteorological Observatory,
Readville P. O., Mass."

These warnings were displayed during May. The result is given in the following taken from the monthly report of the Observatory. "Rain warnings have been displayed during May in accordance with the accompanying circular. The number of warnings issued was 11, of which 8 were followed by rain within an average time of 6 hours after the first display of the signals. No rain occurred without the warning. The verification was therefore 73 per cent. The 1 A. M. indications for New England of the United States Signal Service, tested with regard to the rainfall at Boston in the following 24 hours gave a verification of 52 per cent."

WINTER IN THE CURLEW VALLEY, DAKOTA.—It is sunrise, the mercury marks 32° below zero, and the atmosphere is as motionless as the Indian Ocean in a calm. "What a temperature!" did you exclaim? Yes, according to the thermometer, the mercury is 32° below; but according to the human sensations, it is nothing of the kind. You stand and look at the instrument, and wonder what is the matter. It seems to you a temperature of zero, or possibly 10° below, certainly not more; and so in summer the instrument will occasionally tell you it is 90°, when you cannot

any way make it seem to you more than 75° or 80°. These discrepancies between the mercury and the animal sensations are perhaps unexplainable, but that they do actually exist is too well known to the people of this country to be any longer a matter of question or dispute. Whether it is the altitude and the consequent clearness and rarity of the air, or what it is, the fact remains that 30° below and 90° above are not more extreme in Northwestern Dakota than 10° below and 80° above are in Central or Southern Wisconsin. The morning is clear, and cold, and still; the cattle are arousing themselves from their rest in the open air, stretching, shaking the straw out of their long hair, nibbling a little here and there about the stacks, or wandering off on the prairie to make their breakfasts off the self-cured grass, which is scarcely covered by an overcoat of snow four inches thick. This is the way our stock winters. Of course, every farmer should have a modicum of hay or straw as a reserve against emergencies,—say a possibly deep snow, or something else,—but the most part of the stock take excellent care of themselves, and come through in good condition with very little feeding. They need shelter from the winds, and that is their greatest need; if they have it, they are pretty sure to pull through all right, with so little feeding that we may almost call it none at all.

We take pride, as why should we not, in the richness of our valley and the beauty of our scenery; and we cordially invite so much of the world as can find space here to come and share its beauties and its blessings with us. Here are thousands of acres to the north of us, still untouched and unclaimed; and I say, in all candor, that I do not know of a more inviting spot on the earth to migrate to in this year of grace '85, than the Curlew Valley, in Northwestern Dakota. Somebody says "blizzards" in my hearing. No, not blizzards. This is not the country of cyclones, tornadoes or blizzards. Did you, Mr. Editor, ever hear of one of these west of the Missouri River? I suspect you never did, and never will. We are too near the mountains to be troubled by these destructive winds. In fact we are in the lee and under the protecting wing of the mountains, and the winds can not gather force to rake us here as they do further east and south. Dismiss the idea of blizzards.—*Northwest.*

ROYAL METEOROLOGICAL SOCIETY.—The concluding meeting of this society for the present session was held on Wednesday, the 17th inst., at the Institution of Civil Engineers, 25 Great George street, Mr. R. H. Scott, F. R. S., President, in the chair.

Lieut. A. Leeper, R. N., was elected a fellow of the society.

The following papers were read:

(1.) "A few meteorological observations made on a voyage up the Nile in February and March, 1885," by Dr. W. Marcet, F. R. S. The author on a voyage up the Nile from Cairo to Assouan made a series of meteorological observations, and in the present paper gives the results of those relating mainly to nocturnal radiation and the temperature of the water of the Nile.

(2.) "The Mean Direction of Cirrus Clouds over Europe," by Dr. H. H. Hildebrandson, Hon. Mem. R. Met. Soc. The author has collected a number of observations on the movements of cirrus clouds over various parts of Europe, and after discussing them has arrived at the following results: (1) the mean direction at all stations lies between southwest and northwest; (2) in winter the cirri come from a more northerly direction, and in summer from a more southerly; (3) in winter the northerly component is greater on the Baltic and the north coast of the Mediterranean; (4) the mean directions of the upper currents nearly coincide with the mean tracks of storm-centres; (5) the upper currents of the atmosphere tend in general to flow away from those areas in which a barometrical depression exists at the earth's surface towards those in which there is an elevation of pressure.

(3.) "On the Influence of Accumulation of Snow on Climate," by Dr. A. Woeikoff, Hon. Mem. R. Met. Soc.

(4.) "Note on the Weather of January, 1881," by Mr. C. Harding, F. R. Met. Soc. It will be remembered that the weather of January, 1881, was remarkable for the prolonged and exceptionally severe frost, the heavy gale of the 18th and 19th, and the snow-storms. The author has prepared isobaric charts for the North Atlantic and adjacent continents for January, 1881, and compared it with similar charts for January in other years. He shows that the severe weather in 1881 was due to a reversal of the normal conditions, the atmospheric pressure being high in the north and low in the south.

(5.) "Results of Meteorological observations made in the Solomon Group, 1882–84," by Lieut. A. Leeper, R. N.

(6.) "Graphic Hygrometrical Table," by Mr. D. Cunningham, M. Inst. C. E., F. R. Met. Soc.

EUROPEAN WEATHER, REVIEW FOR MAY.—*Barometric Pressure.*—From the 1st till the 6th there is a maximum in the N. E., and minima travel from W. to E. over Britain, Central Europe and Russia, causing almost continual precipitation and very low temperatures. On the 7th a high pressure appears over Spain and the Mediterranean regions, spreading on the 11th in a N. W. direction to Scotland. On the 13th this maximum has traveled in a S. E. direction to Holland and Central Europe, while a low pressure is disappearing in the N. E., causing snow and rain over Finland. On the 14th a minimum coming from the S. W. is situated over France and Germany, followed by a high pressure W. of Ireland. The low pressure travels in an easterly direction, causing very much rain over Germany, France and Austria, and extraordinary low temperatures. (Munich reports on the 15th at 2 P. M., snow and 33°.) Another disturbance in the N. W. has by this time appeared and the maximum travelled to the Bay of Biscay. On the 16th the first minimum mentioned above is situated near Warsaw after causing a rainfall of 4.73 inches in 24 hours at Vienna. The other hovers north of Scotland and unites on the 17th with the first; the united system travelling in a northeasterly direction is nearly filled up on the 20th. A slight depression being only visible over Austria, but causes there very heavy local rains. Another minimum now appears W. of Ireland, dividing on the 22d into two depressions, one over the N. W. of Scotland and another over south England (Barometer at Hurst Castle 20.1.) The latter travelling in a northeasterly direction is situated on the 23d over the North Sea, after causing very much precipitation over Holland and east England, and also severe storms from the S. W. in some places of the first country. On the approach of a high pressure from the south extending on the 26th from France to Petersburg, the area of low pressure in the N. and N. W. recedes, while the minimum in the west increases. On the 29th high pressure with rising temperature extends from Spain to North

Scandinavia, but on the 30th the area of low pressure has divided into two minima, one of which is situated over Finland, causing rain and high temperatures (up to 66°) over Scandinavia, the low pressure in the N. W. remaining almost stationary till the end of the month.

Temperature.—This month is remarkable for its very low temperature. The mean for Germany being from the 1-27 almost constantly below the normal (down to 20°), from the 28th till the 31st it was above the normal (up to 16°). Lowest temperature at Munich on the 15th 33°, highest on the 29th at Chemnitz 82°.

Valentia, Ireland.—The temperature is below the mean from the 1-11, 13-14, 16-25, 27-31, and above the mean on the 12th, 15th and 26th; lowest on the 13th 43°, highest on the 29th 57°.

Petersburg, Russia.—The temperature is below the mean from 1-10, 13-14, 18-19, 26-29, and above the mean from 11-12, 15-17, 20-25, 30-31, lowest on the 2d 23°, highest on the 24th 75°.

DR. M. BUYSMAN, Middleburg, Holland.

FIRES AND THE WEATHER.—Notwithstanding it may safely be asserted that so many fires and such vast destruction are wholly needless, it is demonstrable that fire losses as a whole happen not as mere accidents but are governed in their occurrence by tolerably well defined laws. The fire wave for a series of years and over the area of the United States has responded to influences which in many cases are quite readily traced.

Let us first look at the influence exerted by atmospheric conditions. From data published by the United State signal service, it appears that the months of March, April, June, July, August and September are distinguished from the remainder of the year by comparatively light rainfalls. Therefore, by dividing the number of fires and the amount of loss into two groups, we procure the following suggestive exhibit:

MONTHS OF LARGEST RAINFALL.

Months	Monthly rainfall (av. many years).	No. of fires. for 9 years.	Total losses for 10 years.
March	3·72 inches	9,366	$63,696,454
April	3·40 "	9,390	69,630,967
June	3·73 "	7,048	53,542,112

July	4·02 inches	8,564	62,180,187
August	3·84 "	9,021	64,241,329
September	3·52 "	8,522	61,354,555
Totals	22·23 inches.	51,911	$374,645,604

MONTHS OF SMALLEST RAINFALL.

Months	Monthly rainfall (av. many years).	No. of fires for 9 years.	Total losses for 10 years.
January	3·35 inches	8,920	$75,038,152
February	3·23 "	7,935	63,087,393
May	3·27 "	8,623	72,085,506
October	2·99 "	9,544	76,052,578
November	3·31 "	9,579	66,322,710
December	3·25 "	9,530	76,372,505
Totals	19·30 inches.	54,131	$438,959,844

This analysis shows that during the six months having the smallest rainfalls four per cent. more fires occurred than during the months having larger rainfalls. Moreover, the fire loss during the former period exceeded by seventeen per cent. the losses during the second period, which, obviously, demonstrates that fires are both more numerous and more destructive during a dry epoch than during a moist one.

If a similar comparison be made in the sections for which meteorological reports are regularly issued, it will be observed that the fire losses, by seasons, follow, inversely, the inches of rainfall, in eight cases out of ten. Thus, the average loss by seasons in the middle Atlantic states, in California, in the south Atlantic states, and in the northwest, has *uniformly* followed the average rainfall. In other sections, now and then, an exception has occurred, but apparently this fundamental law holds true, viz.: *Other things being equal, the fire loss of a locality, for any considerable period, varies inversely with the rainfall.* The larger the area and the longer the period covered, with the more certainty and accuracy can this influence be traced.

"The movement of population toward the arid regions of the extreme west," noted in the census of 1880, is gradually reducing "the average rainfall with relation to the population," and undoubtedly this movement has had an appreciable effect in increasing fire losses.—*From The Chronicle Fire Tables for* 1885.

ATMOSPHERIC FETOR IN MEXICO.—Attention has been repeatedly called to this in the newspaper press in the City of Mexico and copied in our newspapers. The energetic students of science at that place could hardly let the subject pass without investigation, and by recent official reports, we learn that it has received proper attention. It appears that the fetor is due to sewage. This passes into a neighboring lagoon northeast of the city, and, when the water in the lagoon is low and the wind northeast, the stench in the city is sometimes bad. This has been the case in the last spring. The fetor is also, as is pointed out by Señor Pérez, associated usually with a low barometer and dryness. The former, it is generally conceded, permits the gases to escape from the ground and may here allow them to pour from the sewers. The latter, evidently, permits rapid evaporation and thus facilitates the escape of deleterious gases.

The City of Mexico is by nature placed in a very salubrious position. Its elevation and its tropical latitude combined give it a dry and bracing air and a cold and even temperature. But it is also so placed that it is almost impossible to give it efficient sewerage. Water is scarce and the contents of the sewers can not be suitably disposed of on account of the topographical difficulties. These can only be overcome at great expense, but when they are overcome, Mexico should be one of the healthiest cities in the world.

THE VEGETATIVE POWER OF SUNLIGHT.—Though the influence of direct sunshine upon vegetation has long been well known, the recent researches of Dr. M. Buysman indicate a need for a new system of bio-meteorological observations. The constant high temperature within the tropics is the cause of plants there being less dependent on direct solar heat than plants in the temperate zone; but, notwithstanding this, there are plants even in the tropics requiring for a luxuriant growth the direct rays of the sun. This scientist shows, in the journal *Nature*, that direct sunshine (and not mean temperature) is the determining factor of a climate's availability for the satisfactory growth and ripening of the vine, sugar, corn and other important plants. Thus in the rainless, almost cloudless, summer of Bokhara, though forty degrees north

of the Equator, the fruit of the vine is often ripe by the end of June, the soil requiring artificial irrigation, while in other equally warm but more cloudy climes the grapes do not mature until late in September. It has been found that even in the tundra of Siberia on hillsides exposed vertically to the sun's rays herbaceous vegetation with "large, splendid-colored flowers," according to Middendorff, is observed; but it is far otherwise in adjacent plains where the solar rays reach the soil horizontally. The physical law thus brought to light has just been most strikingly exemplified by the observations of the late German expedition to the island of South Georgia. The report of the expedition shows that South Georgia, though lying but two hundred miles further from the Equator than the northern limit of vine culture in Germany, is an almost sunless waste, in which mosses constitute the entire flora.

These facts abundantly show the necessity for adapting, as Dr. Buysman suggests, meteorological researches in all countries to the discovery of the real quantity of both heat and sunlight essential for the profitable growth of the plants most important to human life. By means of the sunshine recorder—an instrument several forms of which have of late years been invented—this most interesting and practical study might be carried on to results which would be of great value to agriculturists. It is much to be desired that the State weather services in the cotton and grain growing districts should institute sunshine observations. Such observations would also be extremely useful in furnishing the most reliable data from which to make estimates of the progress and promise of the growing crops.—*New York Herald.*

Carbonic Acid Tests.—It is well known that the small quantity of this gas in the atmosphere, and the necessity of employing chemical methods in its observation, make its study one requiring much time and some special skill. The present methods being especially difficult of application at sea, Dr. Cordeiro suggests a modification of a common one (Pettenkofer's) which is quite simple, and for the accuracy of which he vouches. It consists in making a standard precipitate of bicarbonate of soda and limewater and using this as a means of comparison with the pre-

cipitate formed by passing air through limewater. When the test-liquid has the same milkiness as the previously prepared solution and the amount of air passed through is known, the carbonic acid in the air is easily determined. The accuracy depends on the judgment by the eye of the exact similarity of the two liquids, and Dr. Cordeiro thinks this can be done with extreme accuracy. This method does not, apparently, present any advantages over Dr. Angus Smith's comparative method when the amount of air necessary to color limewater is judged by shaking up a given quantity of the water in closed bottles. While Dr. Cordeiro's method requires but two flasks, and Dr. Smith's several, the former requires the preparation of the standard precipitate, the latter uses but one solution.

Regular tests for the carbonic acid in the air are carried on at but very few stations; we know of none in this country. The importance of such a study is great, and might prove greater than we now suspect. The difficulty now lies in the labor, time, and expense involved, and such observations can not probably become general until some one hits on an easy, simple, and, if possible, portable instrument for the purpose. Here is an opportunity for invention. A palladium chloride solution has been used in Italy. The solution is put in an electric circuit; when precipitation is caused by the carbonic monoxide in the air, the circuit is completed and a warning bell is rung. Some one has discovered curious reactions from the action of some gases on blown balloons of chloride or nitride of boron or boracic acid. Neither of these tests would give quantitative results. Some one should try a flame rendered very sensitive, when some change in its length might be expected with change in the quantity of carbonic acid in the air. Or the spectroscopic method could be tried. Mr. Keeler has found remarkable peculiarities in the spectroscopic behavior of this gas.

A REMARKABLE HAIL-STORM.

On the 16th of April, 1879, New Orleans was visited by a hail-storm, a phenomenon rare in itself for New Orleans, but presenting such peculiar features that they are regarded as of sufficient interest to be laid before the readers of THE JOURNAL.

The day had been hot and sultry for the season of the year, the maximum temperature being 85°, which was the highest recorded at the United States Signal Station during the month.

The day was fair, and the sky did not present any appearance of an approaching storm, being flecked with slow-moving cumuli.

About 5 P. M., the writer observed two cumulus clouds, which appeared to approach each other from opposite, or nearly opposite, directions. One was a dark looking cloud, moving from a direction about north-west. The other was a white cloud moving from about south-east. It is supposed that the dark appearance of the first cloud was merely the effect due to its position with respect to the sun and the location of the observer.

To an imaginative observer these clouds presented the appearance of two *genii*; approaching cautiously, but nevertheless steadily, to engage in combat.

When the two clouds had joined in contact, the darker one discharged its electricity into the other with such rapidity as to present the appearance of an almost continuous discharge, accompanied by a nearly unbroken reverberation.

The two clouds meanwhile did not become immediately fused, but presented the appearance of a collision of forces; which was followed in a few minutes by a cyclonic motion of the whole system; spreading out gradually, and augmenting in volume, until the whole sky-surface was covered, or nearly so. At the same time the cloud moved slowly forward in a direction about north-east.

The precipitation of hail commenced over the central part of the city, soon after the cyclonic motion of the cloud had been established; and slowly approached the location of the observer, about one mile distant, its approach being heralded by the increasing distinctness of the roaring sound, caused by the falling hail.

A very remarkable feature of this storm was the entire absence of any wind. Prior to and during the fall of hail, the atmosphere appeared to be in absolute equilibrium. I have frequently witnessed hail-storms in the West, and from my recollection of their features I have always considered them to be necessarily associated with winds more or less tempestuous; but on this occasion, upon

some shade trees directly in front of where I was standing, not a leaf was stirred.

The hail-drop was not accompanied by any rain for some minutes after its commencement, but was followed by a heavy rainfall, amounting to nearly three inches.

I did not have a thermometer to refer to, but noticed at the time as something peculiar, that the temperature did not seem to be appreciably lowered. The storm was followed, however, by a very decided fall of temperature,—the maximum on the 17th and 18th being 69°, 16° degrees less than that of the day upon which the storm occurred.

I did not learn whether this storm, *i. e.*, the precipitation of hail, extended far beyond New Orleans, but it would be interesting to know whether the formation of hail, which was manifestly the result of electrical action, was continued after electrical equilibrium of the cloud system had been established.

I. H. Stathem.

A SEVEN DAY WEATHER PERIOD.

Column I of the first half of the accompanying table gives the mean daily pressure at Chicago for each day from May 1 to June 14, 1885.

On examining this, one is struck by an approximately regular oscillation which is seen to occupy about seven days in its completion. Thus the pressure decreased from May 14th to 17th, and rose to the 20th; then again decreased to the 24th, making an exact interval of seven days between the days of minimum pressure It again rose to the 26th, and decreased to the 30th, an interval of six days. The next maximum was reached on June 2d; and minima on the 4th and 7th, at intervals of 5 and 8 days from the last. The pressure at this time differed from the other periods by showing a double minimum; but the pressure from the 4th to the 7th remained continuously below the normal, so that there was really a single *period* of low pressure. Days of minimum pressure occurred again on the 13th, 21st, 27th, and July 6 and 13.

The intervals between all of these are not exactly equal, but approximate seven days.

	CHICAGO.				CHICAGO.			
	Pressure.				Temperature.			
May	I.	II.	III.	IV.	I.	II.	III.	IV.
1	29.90	.....	.....	.....	41°	.....	.....	.....
2	30.10	29.97	.....	.....	40	43°	.....	.....
3	29.92	29.95	.....	.....	47	46	.....	.....
4	29.83	29.78	.....	.....	57	51	.....	.....
5	29.58	29.67	29.79	—.12	55	50	46°	+ 4°
6	29.59	29.66	29.77	—.11	43	46	46	0
7	29.82	29.71	29.77	—.06	39	42	45	— 3
8	29.73	29.80	29.80	—.00	43	41	44	— 3
9	29.84	29.84	29.85	—.01	42	43	45	— 2
10	29.95	29.93	29.91	+.02	44	43	46	— 3
11	29.99	29.97	29.96	+.01	44	47	49	— 2
12	29.97	30.01	29.99	+.02	53	51	53	— 2
13	30.07	30.05	30.01	+.04	55	56	56	0
14	30.11	30.09	30.00	+.09	61	61	59	+ 2
15	30.08	30.05	29.99	+.06	67	66	60	+ 6
16	29.95	29.95	29.99	—.04	71	69	59	+10
17	29.81	29.88	29.99	—.11	69	63	58	+ 5
18	29.89	29.90	29.98	—.08	48	53	57	— 4
19	30.01	29.98	29.96	+.02	42	46	55	— 9
20	30.04	30.03	29.95	+.08	48	47	53	— 6
21	30.03	30.01	29.95	+.06	52	51	53	— 2
22	29.96	29.97	29.95	+.02	53	53	55	— 2
23	29.93	29.90	29.95	—.05	55	57	57	0
24	20.80	29.88	29.94	—.06	64	61	58	+ 3
25	20.90	29.91	29.92	—.01	65	65	58	+ 7
26	30.01	29.97	29.89	+.08	65	61	58	+ 3
27	30.00	29.97	29.87	+.10	53	58	58	0
28	29.91	29.87	29.86	+.01	55	53	58	— 5
29	29.69	29.76	29.85	—.09	52	54	58	— 4
30	29.69	29.72	29.84	—.12	56	57	58	— 1
31	29.77	29.79	29.82	—.03	63	59	59	0
June	I.	II.	III.	IV.	I.	II.	III.	IV.
1	29.90	29.87	29.81	+.06	58°	63°	60°	+ 3°
2	29.94	29.90	29.82	+.08	67	62	61	+ 1
3	29.87	29.83	29.83	.00	60	63	62	+ 1
4	29.69	29.82	29.84	—.02	63	59	63	— 4
5	29.90	29.80	29.85	—.05	53	62	62	0
6	29.80	29.80	29.90	—.10	70	66	61	+ 5
7	29.70	29.84	29.93	—.09	75	64	61	+ 3

(*Continued.*)

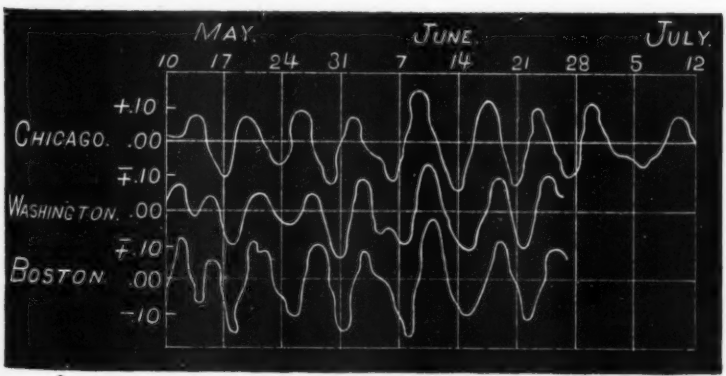
CHICAGO. Pressure.					CHICAGO. Temperature.			
June	I.	II.	III.	IV.	I.	II.	III.	IV.
8	30.02	29.97	29.96	+.01	47°	60°	62°	— 2°
9	30.18	30.12	29.98	+.14	57	55	63	— 8
10	30.17	30.14	29.99	+.15	61	62	64	— 2
11	30.08	30.05	29.99	+.06	68	67	66	+ 1
12	29.91	29.93	29.99	—.06	73	72	68	+ 4
13	29.79	29.86	29.98	—.12	76	75	70	+ 5
14	29.88	29.85	29.98	—.13	75	75	71	+ 4
15	29.87	29.95	29.99	—.04	74	70	71	— 1
16	30.10	30.04	30.01	+.03	61	67	71	— 4
17	30.15	30.14	30.02	+.12	66	66	70	— 4
18	30.17	30.13	30.03	+.10	71	70	68	+ 2
19	30.08	30.05	30.05	.00	73	71	67	+ 4
20	29.90	29.94	30.07	—.13	70	69	66	+ 3
21	29.85	29.97	30.07	—.10	65	63	66	— 3
22	30.17	30.07	30.06	+.01	55	60	66	— 6
23	30.19	30.18	30.06	+.12	61	60	66	— 6
24	30.18	30.15	30.07	+.08	64	66	66	0
25	30.09	30.09	30.08	+.01	72	70	66	+ 4
26	30.01	30.01	30.09	—.08	75	74	66	+ 8
27	29.93	30.00	30.09	—.09	74	71	66	+ 5
28	30.05	30.06	30.08	—.02	63	64	66	— 2
29	30.21	30.16	30.06	+.10	55	59	65	— 6
30	30.22	30.16	30.05	+.11	58	59	65	— 6
July	I.	II.	III.	IV.	I.	II.	III.	IV.
1	30.04	30.07	30.03	+.04	65°	63°	65°	— 2°
2	29.95	29.97	30.00	—.03	66	66	66	0
3	29.93?	29.93	29.96	—.03	68 ?	68	68	0
4	29.91	29.89	29.92	—.03	71	72	71	+ 1
5	29.82	29.84	29.90	—.06	76	74	73	+ 1
6	29.78	29.84	29.90	—.06	75	75	74	+ 1
7	29.91	29.87	29.90	—.03	75	77	74	+ 3
8	29.91	29.91	29.92	—.01	81	76	73	+ 3
9	29.92	29.96	29.93	+.03	73	72	72	0
10	30.05	30.01	29.93	+.08	62	66	71	— 5
11	30.05	30.01	.....	.....	63	65	.....	.....
12	29.94	29.93	.....	.....	70	68	.....	.....
13	29.80	29.86	.....	.....	70	70	.....	.....
14	29.83	.....	.....	.....	71	.....	.....	.....

If beginning with May 17th, intervals of *exactly* seven days be taken, we have May 17, 24, 31, June 7, 14, 21, 28, July 5 and 12. Days of minimum pressure occurred on, or within twenty-four hours of every one of these dates; and days of maximum pressure about half way between them.

By getting the means of every three consecutive days, the smaller irregularities are eliminated, and the oscillation is rendered still more apparent. These means appear in column II of the table.

In order to separate this seven-day oscillation from the oscillations of longer period, the average of every consecutive seven in column II was obtained. Since both the crest and depression of the oscillation occur within this time, the two almost, or entirely, neutralize one another in the average, and only the oscillations of longer period are left. These seven-day averages are given in column III of the table. Subtracting now the numbers in column III, from which the seven-day oscillation are eliminated, from the numbers in column II, in which are combined both the oscillation of seven days and those of longer periods, the latter is eliminated, and the seven-day oscillation alone is left. Column IV. gives the numbers obtained by this last process.

The daily barometric means reported from Boston and Washington were treated in a similar manner, and from the numbers obtained curves were drawn. These curves are given on the accompanying diagram.



The marked regularity of the oscillation is visible in all three, but it is seen that the crests and depressions of the oscillation occur a day or two earlier at Chicago than at the eastern stations. Curves constructed in a similar manner for Bismark, Dak., and Helena, Montana, show that the oscillations occur about a day earlier at Bismark than at Chicago, and about a day earlier at Helena than at Bismark.

The oscillation seems to differ in this respect from the oscillations of twenty-five months, and of thirty days, which were pointed out in previous numbers; since in the latter, a surging up and down of the pressure over any area takes place independent of motions of translation; while in the seven-day oscillation, the individual oscillations are produced by something analogous to the passage of great waves.

The regularity of the oscillation seems broken about the first of May; but notice how the range of the oscillation increases from this time to near the middle of June, then decreases toward the middle of July. This seems to be characteristic of this, as of the other oscillations I have pointed out. I have followed this seven day oscillation for several years; and have found that, at intervals, it rises to considerable prominence, then decreases in intensity, and apparently dies out.* (There seems to be an oscillation of about three days which acts in a similar manner).

The mean daily temperatures reported from Chicago were treated in a similar manner to the pressure. These appear in the second half of the table. It will be seen by column IV. that there was an oscillation of the temperature similar to that of the pressure; but the days of maximum temperature usually occurred one day earlier than the days of minimum pressure, and the days of minimum temperature one day earlier than the days of maximum pressure. The only exception occurred during the latter part of May and first of June.

Days of general rainfall were also connected with the days of minimum pressure, but the seven day oscillation is not so apparent in this as in the pressure and temperature.

*Sometimes when it had decreased in intensity there would be an interval of ten or eleven days between two oscillations and other oscillations would continue to follow the latter at intervals of seven days.

During the time from the middle of May to the middle of July, periods of rainfall occurred at Chicago on May 17, 24, 29-30, June 2-5, 7-8, 13-15, 20-21, 27, July 5-7, 9, and 13-14. Omitting the periods June 2-5 and July 9, it is seen that the other periods are separated by intervals of about seven days, and are coincident with the periods of minimum pressure as shown by the curves. This regularity was not so evident at the eastern stations as at Chicago.

I have found by a study of the meteorological literature accessible that this oscillation has been noticed before, and that, too, fully as much as thirty years ago. The following from the pen of Prof. Jos. Henry appears in the *Patent Office Report* 1858, p. 490; * * "Most persons can remember the occurrence in succession of a series of storms on Sundays. In one case we recollect this to have taken place six times in succession. There is nothing in this particular day to induce the occurrence of a storm, but merely it will be more likely to be remembered when it happens at this time; and although the interval may not precisely be seven days between two storms, yet it may differ so little from this that a part of the first and sixth Sundays may be included in the cycles of disturbance."

In a work on *The Atmospheric System Developed*,* by Thomas. B. Butler, appears the following: "It is doubtless within the recollection and experience of every one who has lived long, that at a remembered period, some particular day in the week, for several weeks, was stormy; sometimes with, and at other times without an intervening storm, or showery condition, on some day in the week."

In *Vennor's Weather Almanac* for 1883, p. 13, it is stated: "We find closely corresponding weather periods have frequently occurred in seven, fourteen and twenty-one year divisions of time, and most of us are familiar with the every seventh storm-day of our winter and summer months.

"Only as recently as last autumn (1881) the general remark was That every Saturday stormed,' and it will be of further interest to the public to learn that these 'stormy Saturdays' lasted through a period of just about seven weeks." He stated in some of his

*Published 1870.

writings that he frequently based predictions on this seven day period.

The weather proverbs current in some sections which state that if it rains on certain Sundays it will rain on every Sunday for a month are no doubt based on observations of this period.

This oscillation, then, seems to have been prominent at intervals at least during the last thirty years, and it is probable that observation of it is older than even history itself; for I feel confident that from it arose, and on it is based, that almost universal popular belief in a connection of the changes of the weather with the changes of the moon, evidence of which is said to have been found in the hieroglyphics of Egypt, and against which modern science has brought her battering rams of argument and proof in vain, for it seems to retain a well nigh invincible hold on the popular mind. I saw it stated by some English scientist not long since that it was surprising how the popular mind clung to this belief.

The moon in one respect was the almost universal timekeeper of our ancestors, and the average duration between the changes of the moon is something less than seven and a half days; what then would be more natural than for a casual observer, noticing the seven day weather oscillation as it rose into prominence from time to time, to notice its close connection in time with the changes of the moon, and suppose that they were cause and effect?

Having traced this oscillation through most of June, I felt convinced it would continue into July, and on it based the following part of my prediction which appeared in the last *Journal*. "It is probable that [over the part of the United States east of the Mississippi] a comparatively high pressure with fair weather will prevail about July 1st, and between the 3d and 6th decidedly lower pressure will prevail with much rainfall. Higher pressure with fair weather will probably again prevail between the 7th and 8th, followed by low pressure with rain between the 10th and 13th, and a decidedly high pressure about the 14th."

On the morning of July 1st an area of high pressure with fair weather was central in the Mississippi Valley, and covered the whole of the eastern United States except the northeast corner. On the 2d the pressure had decreased over this whole area, and

remained lower till about the 6th. Rainfall occurred during this time over the whole, or nearly the whole, of the area, being pretty general on the 6th. On the morning of the 6th the pressure was very high off the New England coast, and very low in Manitoba The high pressure moved toward the southwest, and on the 7th and 8th much the larger part of the United States east of the Mississippi was inclosed by the isobar of 30.10 inches, and the pressure was above 30.00 inches over all except the northwest corner, where during the evening of the 8th some destructive local storms occurred, but from no other stations is rainfall reported. On the the 9th and 10th the pressure decreased, rose again on the 11th and 12th, and was quite low with general rainfall on the 13th and 14th. The days of highest pressure over the area as a whole it is thus seen were July 1 and 7 and 8; and the days of lowest pressure were between July 3-6 and 10-13, just as predicted; but the pressure was not so low and rainfall as great as was expected between the 3-6, and the high pressure expected about the 14th has not yet appeared.

H. Helm Clayton.

Ann Arbor, Mich., July 15, 1885.

TEMPERATURE DIAGRAMS.

Many readers of The Journal are probably teachers of physical geography in our high schools and colleges, and we may suppose that most of these have their own way of looking at certain questions which they describe or illustrate in one method or another, according to their preference. It would be of much assistance to all if these individual methods could be published, so that we might by their use avoid as far as possible the formalities of text-book work. As a contributor to such a collection the author offers the following essay on temperature diagrams, in which the leading idea is to form a series of illustrations that shall represent the general principles of the variations of temperature with altitude in order that the student may learn in what relations to regard the many single facts of this kind that he will meet.

The most general peculiarities of the distribution of terrestrial temperature are shown in figure 1, in which OO is a radial line passing out beyond the earth's surface, LD, through the atmosphere and far beyond into etherial space; scales of height above the surface, and of depth below, are given in miles on the left and in kilometers on the right. The full line curve represents the temperature found at any point along the radius, the temperature scales being given in Farenheit degrees at the top of the diagram and in Centegrade at the bottom, and the radial line passing sensibly through the zero of both scales, with lower temperatures to the right and higher ones to the left.*

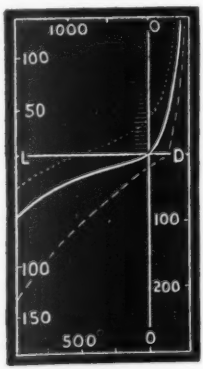


FIG. 1.

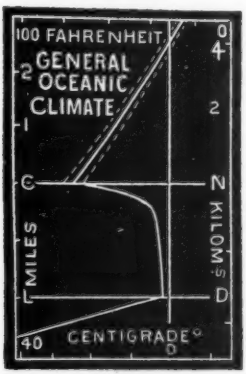


FIG. 2.

The mean temperature of the whole earth's surface, about 60°F, is indicated by the position of the temperature curve where it crosses the space LD. Above the earth temperature falls rather rapidly at first, but slower and slower at great heights, till the absolute cold of outer space is reached: within the earth the temperature rises rapidly at first, but slower and slower at greater depths where the great glowing mass of the earth's interior is entered. The thermometric scale is here so small that the range

*Temperature diagrams are generally constructed with the temperature scale vertical; another position is necessary here, as vertical measure is best given to altitude. But if these figures are turned around so as to lie on their right sides, the curves will then correspond to those usually drawn, with warmth at the top and cold at the bottom.

of temperature through which life can exist makes but a narrow band, indicated by short horizontal lines. In the early stages of the earth's evolution, the intersection of the temperature curve and the life-band must have been miles above the earth's surface, in the dense, vaporous atmosphere of that primeval time. An example of such an altitude is shown in the dotted curve. At a correspondingly late stage, when the earth's surface is chilled far below freezing, the intersection will be found miles deep in the interior, as on the broken curve; the form of the curve not being seriously altered during this progress. The organic part of the earth's history is, therefore, limited to that small fraction of eternity during which the descending intersection of the temperature curve and the life-band stands sensibly on the earth's surface.

The local peculiarities and seasonal variations of the temperature curve about its intersection with the surface require a higher magnifying power, as shown in figures 2 to 6.

The oceans of the torrid zone and neighboring latitudes occupy the greatest area of the earth and present a vast extension of nearly uniform conditions; for this reason they are taken as the typical surface of the planet in figure 2. We here find certain breaks in the temperature curve that were negligible in the first figure, well displayed at the bottom and top of the ocean; and the geosphere, the hydrosphere and the atmosphere now exhibit their well contrasted conditions. The great volume of deep ocean water is within a few degrees of the freezing point, even under the equator, as the result of a slow creeping of the under waters from the poles;* but near the surface the ocean warms rapidly to nearly 80°F., so that the temperature line must make an abrupt turn as it rises through the cooler air; this is at once the sharpest turn to be found in the line of mean temperatures and the part fitted for the most luxuriant life; it might be called the "organic corner." This general oceanic curve, therefore, has certain strongly marked characteristics: it exhibits a departure from the general rule of

*The myth, so long current, that ocean water like fresh water had its maximum density at 39°F., and that therefore the deep ocean water must be of this temperature, has been definitely dispelled by the sounding expeditions of the last fifteen years. Salt water is densest at its freezing point, about 28°F.

decreasing temperatures with increasing distance from the earth's centre; and it shows two distinct angles at the junction of the three terrestrial spheres. Thus far only the mean annual temperature has been mentioned. The range from the hottest months to the coldest months is now indicated by the dotted lines on either side of the mean annual; the greatest range found on a radius through the equatorial oceans is in the air resting on the sea; it disappears almost immediately below the surface, for in the depths of the sea and in the earth below the temperature is invariable from year to year; and it soon fades away in ascending through the atmosphere, as will be shown more distinctly further on. Even at the bottom of the atmosphere, the range is small, for equatorial climates are extraordinarily equable; and the range from day to night is as great as or greater than that from summer to winter. There are certain regions where this normal oceanic curve is seriously altered; the Arctic seas naturally form one exception, the Mediterranean seas form the other.

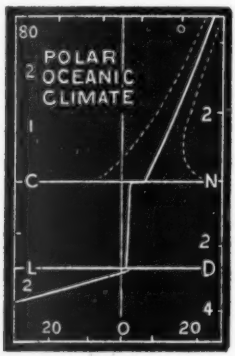


Fig. 3.

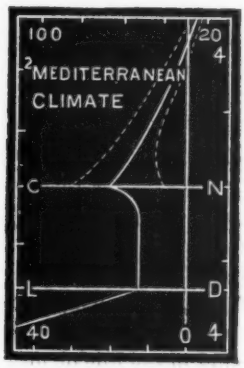


Fig. 4.

Figure 3 illustrates the temperature variations along a radius emerging through the polar ocean. The uniformly low temperature, a little below the freezing point of fresh water, from bottom to surface, and the consequent absence of the organic corner, is now the most striking feature; here is the source of the cold water that we have already found under the equator. Summer heat cannot rise much above freezing, and as long as the sea is unfrozen,

atmospheric temperatures do not change very greatly; but when the sea freezes over, the minima may fall very low, and so carry the mean of the air temperatures decidedly to the right of the point where the temperature line seems to emerge from the ocean. At the times of such low minima, the ærial curve is pretty surely reversed from its ordinary form, so as to show an increase of warmth up to a certain altitude, after which the normal decrease is resumed. The reversal is characteristic of all epochs of rapidly falling or extremely low surface temperatures, and depend chiefly on the slowness with which the air cools by its own radiation. Close to the surface on which it rests, it will be controlled by the more quickly changing temperatures of that surface; but up aloft, its variations will be small, as there they must depend on its very imperfect absorption and radiation of heat.

The theory that ascribes a polar origin to the cold water of the deep equatorial ocean is completely established by the absence of cold water at equal depths in mediterranean seas, to which the deep polar currents have no access. The original Mediterranean is the best example of all (Fig. 4): it is large, almost entirely land-locked and very deep; and for the greater part of its depth it has a constant temperature close to 55° F. Any water that comes from the Atlantic cannot be colder than this, for the temperature in the ocean at the depth of the strait of Gibraltar is not lower than 55°; and although the surface of the Mediterranean may fall to winter minima as low as 40°, such chills are of short duration, and the amount of surface water cooled by them is so small that it is soon lost in the warmer water through which it sinks. All mediterranean seas show this characteristic mass of relatively warm, deep water, the difference of its temperature from that of the adjacent oceanic abysses increasing with the shallowness of the connecting channels. The Sulu sea, enclosed by the Philippine Islands, is a remarkable example discovered by the "Challenger." The air temperatures are significant of mediterranean conditions in their marked variations, due to the control that the near adjoining lands possess over them. The sirocco from the Sahara brings air of a warmth abnormal to a sea climate, and the Mistral and Bora carry unusual cold out over the Gulf of the Lion and down the Adriatic.

When continental masses appear above [the ocean, the radial line through them passes directly from the geosphere to the atmosphere. Three examples will present the most striking types of this occurrence: a torrid desert, a far northern interior, and a high mountain. The absence of the ocean gives the mean temperature curves a simpler form, but allows much wider variations from minimum to maximum.

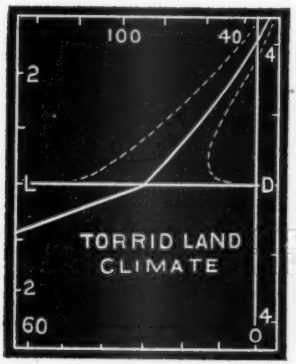


FIG 5.

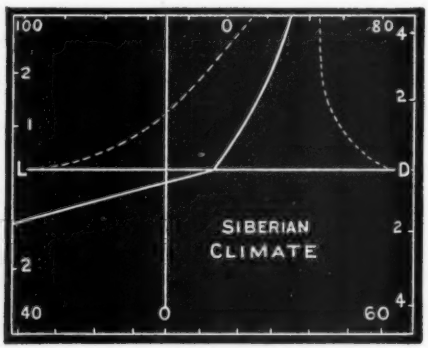


FIG. 6.

Figure 5 represents the conditions on a torrid desert. The mean temperature at the surface is high, and hence the vertical decrease is rather rapid, as is shown by the strong right-hand tendency of the air temperature line. The maximum of the hot noons rises well over 100° F., and the minimum sinks almost to the freezing during the rapid radiation of clear, quiet, dry nights. The first is the very unstable condition of the atmosphere during which dust whirlwinds spring up; the second gives one of the many examples of inverted temperatures, with cooler air on the ground than at a thousand or two feet above it, and perfect stillness then reigns.

The most violent of known climates is represented in Fig. 6. North-eastern Siberia, although nominally in the temperate zone, has such excessive variations from summer warmth to winter cold that its mean annual temperature is purely an abstraction, seldom dwelt upon by the thermometer-readings, and in this respect it is in strong contrast to the equatorial oceanic climate, where nearly

every day's range crosses the mean of the year. Below ground the low mean temperature has a novel effect, not yet anywhere permitted in the circulating waters of the ocean; the temperature line crosses the freezing line below the surface, probably at a depth of five hundred feet or more, and down to this depth, the ground is permanently frozen, with the exception of a thin surface layer that melts to allow a brief cultivation in the summer. The mean decrease of temperature vertically to the uniform cold of the upper air must of course be distinctly slower than that represented in the preceding example, as the point whence the temperature line begins to rise into the atmosphere is so much farther to the right here than on the hot desert. But the most characteristic feature here is the enormous range of temperature with the seasons, amounting to 170° F., as a result of high latitude, small altitude, and great distance from the sea. The July mean may rise over 60°, while the absolute maximum is above 90°; but as the warm season is short, the higher temperature must be limited to only the lower air. Still, the low barometric pressure here and the centripetal winds of the surrounding countries imply a warmth well above the mean for a considerable altitude during the summer, just as the very high pressure and outflowing winds in the winter demonstrate that a thick mass of air has been cooled; the January mean is about 40° F., and the absolute minimum falls to 80° F! At such times the inversion of the temperature curve is very marked; the mean winter temperature of the low lands being distinctly colder than that of the adjacent mountain stations.

Hann's *Klimatologie* and Boguslawski's *Ozeanographie* have furnished most of the numerical data for the diagrams here presented. The temperature at the surface lines (LD) are sufficiently exact, and those below the surface are probably near the truth; but the temperature curves of the upper air may need considerable quantitative modification, although it is hoped that the quality of their curvature is correct.

W. M. DAVIS.

CAMBRIDGE, May 9, 1885.

SELECTED ARTICLES.

THERMAL LEVELS.

DISCREPANCY IN THERMOMETER MARKS EXPLAINED.

The general fact that the temperature of the air varies with different levels above the earth's surface has long been recognized. Meteorologists tell us that there is usually a fall of one degree Fahr. for every 300 feet of ascent above the sea level, with certain variations for local causes. We may call this a meteorological thermal fluctuation, and it is always marked by a fall of temperature with increased elevation. But there is an equally important change of temperature in the opposite direction, of great importance to the farmer and fruit grower, namely, a loss of temperature as we descend into valleys. In early years I was a country doctor, and had to take many a long ride in the night. The road passed from a high bluff into a deep valley, with another bluff on the opposite side. When the air was still I could detect by the change of temperature the transition from the warm air of the bluffs to the chilly air of the valley. It was like passing into a cold stream of water, and the change was equally abrupt on passing into the warm air on the opposite bluff.

I appreciate the fact that one's feelings can hardly be accepted as a reliable test of temperature and that a thermometer is better than a sensation to furnish reliable physical data. The temperture of the "open air" for any given locality, and for the same time, is supposed by most persons to be a definite and uniform quantity. If two persons in the same neighborhood report different temperatures for the same hour, it is supposed that such difference must arise from a difference in the correctness of the thermometers, or some accidental variation of exposure, it being assumed that the "temperature of the open air" for a given locality and identical time would be the same. Many persons suppose it is a very simple thing to determine the temperature of the open air; it is only neeessary to hang the thermometer outdoors till it

has reached a point of no fluctuation and then read off the temperature by the thermometer scale. But when trial is made even with thermometers that compare favorably with each other under identical conditions, a marked discrepancy is often observed in places of near neighborhood

This is especially true if the thermometers are at different levels and there is no wind. We treat of air under the head of pneumatics, whereas it sometimes comes rather under the head of hydraulics, for *cold air flows in currents the same as fluids.* In the absence of wind which mixes up the strata of air of different temperatures, and consequently of different specific gravity, the cold air of the night will flow in streams and gather in ponds or lakes the same as water. Under such circumstances the temperature will vary with the level, and the subject of thermal levels becomes a matter of importance. I have made many observations to determine the difference of temperature with slight differences of elevation. An open air thermometer hangs at the north door of my laboratory, adjusted to avoid accidental variations of temperature. A ravine runs through the college lawn near the laboratory. A thermometer was placed in the ravine 150 feet from the one by the laboratory door and 25 feet below its level. In very cold weather, when the air was very still, I have occasionally seen the thermometer in the ravine mark 8° below the thermometer at laboratory door.

During the cold weather of last month I again examined the relative temperature at these two points, selecting mornings with little wind for such observations and reached the following results:

February 22, at 6:45 A. M., laboratory.....—15°
February 22, at 6:45 A. M., ravine.....—20°
February 23, at 6:30 A. M., laboratory.....—15°
February 23, at 6:30 A. M., ravine.....—20°

A slight breeze with velocity of two miles an hour was blowing on both mornings. The lowest temperature on the preceding nights at my meteorological station (about forty rods distant, and on higher ground than the laboratory) was—14°.

February 24, at 6:30 A. M., laboratory.....—1°
February 24, at 6:30 A. M., ravine.....—4°

I then carried the thermometer from the ravine and hung it by

the side of the one at the laboratory, and they soon marked the same temperature—1°. I carried the thermometer ("Green's Standard") back to the ravine and placed it about two feet lower, and in the narrow channel of the ravine, and it soon reached—5°. The minimum temperature at my station for the night was 1°.

These investigations show that thermal levels, or marked changes of temperature with slight differences of elevation, are facts of great importance to the farmer and fruit-grower where the difference of a few degrees of temperature makes the difference between success and failure. A very intelligent fruit-grower in the Traverse region had on his farm a long narrow valley of sandy soil which descended somewhat rapidly into another deeper valley below; about half way down this upper valley was a bank or dam of sand cutting across the valley like a mill-dam across a stream. The soil being a warm quick sand was cultivated, and good crops secured save in the air pond above the dam. No frost troubled the crops in other parts of the valley. Tiring of this dam and weary of the frosts, he removed the dam and opened up the valley for its full length. He had no more frosts in his former frost pond, but the aerial torrent now left its frost marks in the lower part of the valley, where the crops had never been troubled before the dam was removed. Aerial drainage is a subject that will demand more attention in the future.—Dr. R. C. Kedzie in *New York Tribune.*

CAPTAIN PARSELLE'S WAVES.

Captain Parselle, of the White Star steamship Adriatic, has been plowing the boundless main, says the New York *Tribune*, these forty years. He has navigated every ocean and almost every known body of water large enough to float a ship. During recent years he has commanded some one of the Liverpool steamers of the White Star line, and has thousands of acquaintances in this city who know well what an honest, bluff, straightforward old sea-dog he is. This introduction would be totally unnecessary but for the miraculous nature of the stories which are to follow, and which, says Captain Parselle, "are as true and as sure as that the sun is now shining at us here on my deck."

The conversation which had preceded these wonderful tales had referred to the storm-wave lately encountered in mid-ocean by the Germanic. The captain explained what sort of a sea it was. "The newspapers called it a tidal wave," said he, "but it was nothing of the sort. Tidal waves only occur in bays, firths and rivers. I saw a tidal wave once from a high bluff on the banks of the Ganges. It was a perpendicular wall of water advancing at the rate of about twenty miles an hour. It was perfectly straight, except at the very top, where it crested into a foam that had not strength enough to fall. It was about seventeen feet high. That was a pure tidal wave, and I have never yet been able to work out its origin or cause.

"Now a storm-wave, such as struck the Germanic, is a very different thing, and is explicable upon thoroughly well-defined meteorological principles. The wind in a first-class ocean storm blows with terrific force, and of course creates tremendously heavy seas. The sea recovers very slowly, so that after the wind has veered from south to north, the seas come at you in engulfing waves in every conceivable direction. Now, there is a point where the influence of all these seas unite, producing a wave that reaches incredible altitudes with a force that is simply irresistible. That is a storm-wave, and that is what knocked the Germanic. No seaman can locate it, and if you happen to be in its path all you can do is—take it.

"Have I ever encountered one? Well, I should say so. Thirty-three years ago I was the chief officer of a nine hundred-ton ship. We sailed between London and India. One evening, when a few hours out from London, in the English channel, the time came to relieve the watch. That was 8 o'clock. The sky was a little murky, but not absolutely cloudy. The channel waters were calm. The breeze was fresh, blowing from the west at such a rate as to compel us to sail under a reefed mainsail and double-reefed topsails. On our lee side was a brig. My captain and I were standing together on deck. I had given orders for the watch to be called, and they were then assembled on the poop deck. The captain said to me, 'Mr. Parselle, I think the light ought to be visible by this time'—meaning the Eddystone light. 'Suppose I go aloft and look,' I answered.

"I went up the rigging till I got about sixty feet aloft, and suddenly when in that perilous position, I heard a terrible shout from the deck. I looked down to see what was the matter, and just as I did so, a mountain of water struck us amidships. It picked me right off my feet and hurled me clear through the rigging, and flattened me against the mast, whence I fell down into the maintop. The rest of what happened I discovered after my recovery. The wave took off every strip of rigging and canvass, all the yards, boats, and arms, and left the ship with only her masts standing. We ran back to the Isle of Wight and anchored in the Solent to ascertain the extent of the damage, and then we discovered the most wonderful thing of all. The ship had been sheathed with copper, and the wave had stripped its top sheet off for eighty feet of the ship's length, as clean as a mechanic's shears could have done.

"How did it happen? Don't ask me. I suppose there may have been a little hole in the copper, and the water was forced into it with such immeasureable power as to have the effect I have described. But you remember I told you there was a brig to the leeward of us. The next morning we saw her lying astern of us in the Solent. Her masts were gone, and if an army of carpenters had been at work cleaning off her deck they could not have left her more barren than that wave did. Her watch had been swept overboard and every man of them lost.

"Well, that was a storm-wave for you, but I struck one in 1877 that was much more remarkable. I was off the coast of Japan, captain of one of the finest steamships afloat. We were in a typhoon. They call them typhoons there, but they are identical in character with our own cyclone and the African tornado. It was an awful storm, the worst I ever saw. The wind howled and shrieked and raved like a million demons loosed from the Styx. The seas struggled with each other for our possession, and roared the most infernal noise, as they broke over us in merciless force. The sky was inky, but not a drop of water fell. My chief officer and myself were standing on the bridge directing the helm. Suddenly directly in front of us, about a hundred yards away, I saw a most prodigious mountain of water. Its towering crest was lashed into a white foam, and appeared just between the two yards

of the mast. Above the hellish din of the storm I could hear the awful bass roar of that monster wave as it came toward us like a steam-engine. I turned to my officer. His face was as white as chalk.

"'Here's the last of our good boat, my boy,' I said, and turned her nose right into the wave.

"Her bow rose until we were almost perpendicular. I almost thought we should be thrown over. The crest struck us and blinded me so that I could not see. And then, so sure as I am an honest man, her bow fell and her keel rose, and we passed over that most terrific wave as gently as a chip over a mill-pond ripple! I never was so dumbfounded in my life, for I fully expected that moment to be the last that ship would ever know. These two yarns, mind you, are my own personal experiences, and I give my word of honor for their truth."

LITERARY NOTES.

(71) **Hay Fever** *and its Successful Treatment by Superficial Organic Alteration of the Nasal Mucous Membrane*, by Charles E. Sarjou, Philadelphia, 1885. F. A. Davis, 1217 Filbert st. Small 8 vo. 103 pp. 13 wood cuts. This little treatise is of interest to those of our readers who may not be subject to hay fever, from the fact that its author, a special student of the disease, commits himself unreservedly to the theory that the disease is caused by irritating substances floating in the air. The substances are usually pollen, but may be other things, as perfumes, dust, etc. Different pollens affect different persons; while that of ragweed is a common irritant, it fails entirely to affect some persons. Some are affected by only one irritant, others by several. As a contribution to the subject of extraneous substances floating in the air this little book is of general interest; of much more interest is it to the sufferers from hay fever, and these we must refer to the book itself. H.

(72) **Smithsonian Meteorological and Physical Tables**, 4th edition, 1884, 8 vo. 738 pp. Washington, 1884. This last edition of Professor Guyot's excellent tables is much enlarged. It was practically completed at the time of the author's death; a few of the last tables only having been left to the hands of his assistant. The change in and additions to the tables have been considerable. The table for obtaining the tension of vapor and relative humidity from the dry and wet bulb thermometers has been increased by the much needed addition of the valves when the difference of the two thermometers is from 26°.5 to 29°.5. The tables for comparison for measures of length have been much modified and adapted to present requirements. It formerly contained only measures for altitudes, but now includes those for geographical lengths and surfaces. The various geodetic tables are now calculated by the formula of Col. Clarke, and some new ones are added. A table of duration of daily insolation is given.

The book is made much more valuable by continuous paging and an index. As it now stands it is indispensable to meteorologists and physical geographers. Those of middle age know it well already, and the former editions have been well thumbed over by them. The younger ones should become as well acquainted with this new and improved edition.

The book seems to be nearly free from errors. We note that in the index, "Observatories" should be on p. 689, and not 608. H.

(73) **Societa Meteorologica Italiana**, Bollettino decadico pubblicato per cura dell' Osservatorio Centrale del Real Collegio Carlo Alberto in Moncalieri, 13th year, No. 7, June 1884, 4th, p. 97–112. This is the monthly official publication of the Italian Meteorological Society, of which Sr. P. Francesco Denza is director. It is a year behind, but special effort is to be made to bring it up nearer to date hereafter. It consists largely of the *résumés* of observations taken at its nearly 300 stations, and given both for the month and for the decade. There is also a page devoted to the relative microseismic intensities for each decade for 21 stations, at one of which (Velletri) the number of observations reached the large figure of 970. Besides these there is a brief description of each decade, notes on the state of the volcanoes—Vesuvius, Stromboli, Etna, (the latter giving occasion for many notes,) and divers notes. Among the last we find "microfono romoroso," showing the detail to which observations are taken. H.

(74) **E. Pini** *Sui temporali osservati nell' Italia superiore durante l'anno*, 1879. This is publication number XVIII of the Royal observatory of Brera, in Milan, and is a continuation of the elaborate and conscientious studies of storms, which are so creditable to the Italian meteorologists. This is the sixth year of the series, begun with 1874, and is a large octavo of 150 pages, and numerous maps. This memoir is made on the model of the preceding, already noticed in this JOURNAL, but surpasses them all in the extent and thoroughness of the work. The number of stations for 1879 reached 470, and of communications received 4,500. H.

(75) **S. P. Langley**. *Researches on Solar Heat and its Absorption by the Earth's Atmosphere.* A report of the Mt. Whitney expedition. Professional Papers of the Signal Service, No. XV. Large 8vo. bound, 242 pages, with numerous illustrations and maps. This excellent report is rather of the nature of a memoir on what has heretofore been called actinometry. This makes it all the more valuable to students, and we commend it to them without reservation. The questions discussed, formerly considered astronomical, are of the highest meteorological importance, as the author points out. Indeed, these questions form the fundamental meteorology and we can not build up a secure system until these foundation stones have been well shaped and laid. In this report the student will find an excellent physical discussion of the subject. The main novel feature of the report is the stress that the author puts on the selective absorption by the atmosphere, of the solar radiations. This is a point on which the author has been insisting for some years. It changes the face of the problems involved, complicates them much, and renders useless, methods much in vogue formerly. The simplicity which we would like does not exist, and we would gain nothing by imagining that it does. We not only commend the report to students,

but insist that they must study it if they wish to be competent meteorologists. H.

(76) **Pilot Charts** for May and June. Hydrographic office, Washington. These are, as usual, filled with facts of great meteorological interest. We commend the following appeal to the attention of our readers. We take it from the charts:

"The success of the Pilot Chart must depend on the coöperation of the merchant marine. This has been very freely given, but not to such an extent as is desirable. There is much valuable and interesting information which is withheld by seamen, from one cause or another, which is not disseminated as it should be for the common benefit of all seafaring men.

Masters of vessels are earnestly requested, therefore, to note anything of interest to the maritime community afloat or ashore, and report it as soon as possible to the Hydrographic Office, at Washington, or to one of the Branch Offices in the principal sea-board cities. These offices are established in the

Custom House, Boston, Mass.
Maritime Exchange, New York, N. Y.
Maritime Exchange, Philadelphia, Pa.
Board of Trade, Baltimore, Md.
Maritime Association, New Orleans, La.
Merchants' Exchange, San Francisco, Cal."

During May floating ice came down to latitude 38° or 39° on the meridian of 50.° The following account of a waterspout is much more detailed than usual and will be read with interest:

"The German bark 'Ceylon,' April 10, 1885, in latitude 31° N., longitude 71° W., was struck by a waterspout carrying away main and mizzen masts close to the deck. During the early part of the night two distant thunder storms crossed the sky. All sail was furled except reefed lower topsails. Near midnight a low cloud was observed about 5° above the horizon, the remainder of the sky being clear. The ship was heading N NW., with a gentle breeze from SW. Suddenly, something that at first seemed a ship, was seen quite near bearing W NW. This proved to be a waterspout close aboard. The wind struck the bow with hurricane force, while at the wheel aft it became a dead calm. The vessel was thrown over to starboard until the lower yard-arms almost touched the water. Her head was forced round from N NW., to S SE., and the sails torn into ribbons. Then, as the wind came round to starboard, the vessel righted and came over to port until the rail was under water. The main and mizzen masts were whipped out in an instant. Then suddenly it became calm and the vessel righted. The captain thinks it all occurred within two or three minutes. During the time they were in the

influence of the waterspout there was a great deal of St. Elmo fire on all the iron-work of the vessel."

The recent observations on the use of oil at sea and on wave motions we have called attention to elsewhere. H.

(77) **Rapport Annuel** sur l'état de l'observatoire de Paris pour l'année 1884, par M. le Contre-Amiral Mouchez, Directeur, 32 pages, large 8vo, Paris, 1885. In addition to its astronomical work the Observatory pursues the following lines of physical interest.

1. Magnetic observations, under M. Wolf. Considerable difficulty has been experienced in the establishment of the instruments in deep cellars of the Observatory, on account of dampness.

2. Continuous registers of temperature and pressure on Rédiers instruments, and of the wind with Bourdon's anemometer. M. Bourdon is now deceased, and the registers will be cared for by his sons.

3. Study of movements of the soil in the catacombs. The apparatus shows a surprising stability in the soil there.

The report contains a fine reproduction, by heliogravure, of a photograph of the clusters in Perseus. The photograph was taken by the M. M. Henry on October 10, 1884. H.

(78) **Boletin del Ministerio de Fomento** *de la República Mexicana* After a long absence, we receive 25 numbers of this tri-weekly. It contains much of interest. Among the interesting matters of these numbers, we may mention a detailed study by several hands of the fetor experienced occasionally at the City of Mexico. This is now definitely laid to the accumulated and decaying sewage of the City in Lake Texcoco. The Lake is now shallow and the sewage is exposed to cooking by the sun. It seems also in part due to the leakage of the sewers in some parts of the city during the passage of areas of low barometric pressure. We may also mention a study of the sand dunes in the littoral Gulf region. Attention is more especially directed to their spontaneous vegetation, and the means of reclaiming them, but the papers include many notes of interest to meteorologists.

Our meteorologists should not forget that, as we have previously stated in these columns, the *Boletin* contains hourly meteorological observations by the Central Observatory at the City of Mexico, with *résumés*, also forest, phenological, and magnetic observations. A set of these papers is very valuable, and we think that being published by the government, they will be sent to any one giving a fair exchange for them. H.

(79) **G. Cellerier,** *Concours national de compensation de chronomètres pour les températures.* Published by the Swiss Journal of Horology, Geneva, 1885; large 8vo, 77 pp., 63 diagrams. This memoir includes the classification employed, and the study of the secondary error. The specimens

studied were Swiss but, by both method and results, it is an important study for our horologists. H.

(80) **O. Doering.** *La Pression atmosférica de Córdoba de media en media Hora.* From the Bulletin of the National Academy of Sciences, Buenos Aires, 1885; 8vo, 43 pp., (separately paged). Dr. Doering has a Hottinger aneroid barograph which makes a record every half hour. In this publication the reduction of the records is given for January and February, 1882, 1883 and 1884.

(81) **O. Doering,** *observaciones meteorológicas hechas en Mil Nogales (Cordoba,) por el Sr. Don Ramon J. Moreno.* From the Bulletin of the National Academy of Sciences, Buenos Aires, 1885; 8vo, 26 pp., (separately paged). These are observations of temperature, cloudiness and wind due to the scientific interest of Sr. Moreno, an extensive landholder. They include the first ten months of 1884.

(82) **K. K. Central Anstalt Fur Meteorologie und Erd Magnetismus,** DR. J. HANN, DIRECTOR, *Jahrbuch für* 1883. New Series, Volume XX, Official Publication, Vienna, 1885, 4to. 352 pp. This volume gives the observations and summaries, in the usual form, for the Austrian Meteorological Service. Under the direction of Dr. Hann, it could not be otherwise than a model of scientific accuracy. The hourly observations are given for the central observatory at Vienna, with the results of the hourly observations at five other stations. The daily observations are given for nineteen stations. For the other stations only the monthly and annual summaries are given. The total number of stations reporting are: First class 9, second class 142, (of which three are foreign), third class 160, in all 311. The magnetic part fills 47 pages. H.

(83) **Geo. Vasey.** *A Descriptive Catalogue of the Grasses of the United States.* Published by the Agricultural Department, 8 vo. 110 pp. We commend this pamphlet to our agricultural readers. Dr. Vasey has spent many years in the study of the grasses and his scientific accuracy can be relied on. At the same time the pamphlet is filled with practical notes on our grasses which must be of great interest to the prudent and educated farmer. H.

(84) **W. Huggins.** *The Solar Corona.* A discourse delivered at the Royal Institution, February 20, 1885, 8vo. 13 pp. Dr Huggins finds it is possible to photograph the solar corona, though great care must be exercised in doing it. From photographs made on May 6, 1884, and compared with those made during the eclipse on Caroline Island, he finds that there is some permanency in the phenomenon as well as some similiarity in its appearance as observed at widely different points. Dr. Huggins thinks it possible that the corona is due to an incandescent fog in the neighborhood of the sun, which scatters the photospheric light. He

is consequently not a supporter of Professor Hastings' theory that it has no objective existence. H.

(85) **The Climate** *of New Mexico and Las Vegas Hot Springs*, Chicago, 1885, 8vo. 16 pp. This pamphlet is published by the owners of the Las Vegas hotels, and contains meteorological and other interesting matter, of an authentic character, of importance to physicians and invalids. It can doubtless be obtained by written application to the Las Vegas Hot Springs Hotel, or to the A. T. & S. F. Railroad at Topeka, Kansas.

(86) **The Wonderland Route** *to the Pacific Coast.* A finely illustrated account of the northern route (64 pp) and especially of the Yellowstone Park, of none the less value, that it has been prepared by the Northern Pacific R. R., for free distribution.

(87) **J. Hann**. *The Reduction of Temperature Means from short Series of Observations to the Equivalents of Longer Periods.* From the Quarterly Journal of the Royal Meteorological Society, January 1885, pp. 28-36. Reprint. The author thinks that, notwithstanding serious drawbacks, the reduction indicated in the title does bring with it a certain definite advantage in all cases which practically come under the consideration of the meteorologist. He especially regrets that this is not done for the North American observations. H.

(88) **Signal Service Notes No. XIX.** *Report on the Tornado of August 28, 1884, near Huron, Dakota, by Sam. W. Glenn.* Washington, 1885, 8vo. 10 pp. with a diagram of the meteorological elements for 36 hours, 5 figures of accompanying conditions, and 5 copies of crayon sketches taken at the time. This is a very valuable contribution to our knowledge of this remarkable tornado, made by a competent observer on the ground. Sergeant Glenn does not mention the disputed subject of the photograph said to have been taken at the time. He could probably give us some information on the subject and we regret that he has not done so. His sketches of the tornado forms are especially interesting. He believes that electricity played an important part in this tornado. H.

(89) **C. H McLeod**. *Abstract of Meteorological Observations at McGill College*, Montreal, Canada. Separate sheets with daily means of the usual meteorological elements, printed monthly. The observatory is 187 feet above sea-level.

(90) **Patrick Hamilton** *The Resources of Arizona*, third edition, San Francisco, 1884, 8vo. 414 pp., map and numerous illustrations. This book is published by the Territory for gratuitous distribution, but does not have the usual characteristics of a publication of that kind. It is gotten up with great care, in a good and permanent form, and is apparently entirely trustworthy and authentic. Its views are not entirely

rose-colored and the moderation of its statements commend it to the reader. The chapter on climate gives a good popular view of the subject and meteorologists will find much of interest in it and in other chapters. H.

(91) **Signal Service Notes No. XX.** Thunder storms of May, 1884, by H. A. Hazen, Junior Professor, office of the Chief Signal Officer, Washington, 1885, 8vo. 8 pp. 2 charts. From a study of the hailstorms of the month and the hailstorms of May 18 and 19, the author arrives at the following conclusions:—"1st. Hail-falls occur ordinarily with pressure much below the normal to the southeast of LOW, and at a distance from it of two hundred or three hundred miles. 2d. Thunder-storms advance from the west toward the east and southeast, generally accompanying a LOW, and in the southeast quadrant at a distance of four hundred to five hundred miles. 3d. The action seems to die down at night and begin again in the morning, and often spreads in a fan shape to southeast and east. 4th. The velocity of the thunder-storms is greater than that of the accompanying LOW." These are preliminary deductions but give some idea of the direction that Professor Hazen's laborious studies are taking. He should have the cordial assistance of all interested in the subject,—and who is not interested? H.

(92) **Annuaire** pour l'an 1885, publié par le Bureau des Longitudes, Paris, 32mo., pp, 890. This excellent little annual contains for this year the usual tables brought up to this year, but its scientific notices are astronomical, M. Faye's notice, "Sur la formation de l'univers et du monde solaire," is interesting to everyone, and his charming style adds to its intrinsic attractions. It fills 48 pages and is illustrated. H.

(93) **Radcliffe Observatory.** Vol. XXXIX. Meteorological observations for 1881, under direction of E. J. Stone, M. A. F. R. S., Radcliffe Observer, Oxford, 1884, 8vo. pp. 130. This institution has a good set of registering instruments the reading of which, and observations on the other instruments are here given. Traces of the curves for the storms of October 23-29, 1882, are also given. Meteorologists, who have not turned to the annual volumes of this observatory will find a valuable mine of observations awaiting their treatment. H.

(94) **Bulletinul Ministerului Agriculturei,** *Industriei, Comerciului, si Domeniilor*, 1st year, Bucharest, 8vo. Nos. 1 and 2, 106 and 334+10 pp., several diagrams and plates. These bulletins relate to the entire department of agriculture, etc., of the Roumanian government, in which is placed the weather-service. The latter includes nine pages in Nos. 1 and 10 in No. 2. The "studies" also contain matter of meteorological interest.

(95) **J. Kiessling.** *Die Dämmerungserscheinungen im Jahre* 1883, *und ihre physikalische Erklärung*, Hamburg and Leipzig, 1885, 8 vo. 51 pp., 5 wood-

cuts. Professor Kiessling has here attacked the problem of the twilight glows by a method which is as yet too little employed by meteorologists,—viz., the experimental method. He has devised a simple apparatus by means of which he can reproduce, on a small scale, enough of the twilight and other atmospheric optical phenomena to assure himself of a correct explanation. He finds in the remarkable twilight colors of the past year and a half, only an exaggeration of those familiar from time immemorial, which were due to vast quantities of solid particles of nearly uniform size in the air. About these collected the condensed moisture of the atmosphere. In the memoir is included a striking, almost dramatic, analysis of the ordinary twilight phenomena.

H.

(96) **U. S. Geological Survey,** *Bulletin No.* 5. A Dictionary of Altitudes in the United States, by Henry Gannett, Chief Geographer, 8vo. 326 pp. *Bulletin No.* 6, elevations in the Dominion of Canada, by J. W. Spencer, 8vo. 43 pp. Washington, 1884. The first mentioned is the 4th edition of a list highly esteemed since it was first issued. It was at first confined to west of the Mississippi River, but is now enlarged to cover the entire country. It now contains 1,700 or 1,800 elevations, for the most part obtained by railroad surveys. The second contains the railway and canal elevations in Quebec and Ontario, which number about 500.

The lists are of the greatest use to all interested in altitudes and this includes all meteorologists. They can be obtained of the director of the survey at Washington for 25 cents. The list could be very much enlarged by taking the miscellaneous determinations made over the territory included and published in state documents, Petermann's Mittheilungen and elsewhere. We think, also, that the list would be much improved by adding another column giving the point in the town where the determination has been made. For instance three determinations are given for Santa Fe. They are all different but may be all correct. To complete the information the place where each is taken should be given.

H.

CORRESPONDENCE.

WEATHER OF BEXAR COUNTY, TEXAS.

TO THE EDITOR:—A remarkably heavy rain storm of about 12 hours' duration visited this region on September 6, 1882. The rain-fall, as measured by the writer at this point, 20 miles S. S. E. of San Antonio, was a little over 12 inches.

This appeared to be the close of a series of rain-falls more heavy and extensive than usual, and which began near the end of the preceding month, in the north-western portion of this State, causing disastrous floods, especially in the vicinity of Fort Concho.

A singular and decided change to drier weather seemed to follow, and characterize the average weather for two years following.

During 1883 the precipitation was below the average here, the spring rains being light, and, virtually, ending in March with light and scattering showers, only, through the summer. The autumn rains were also more moderate and partial than usual. It was specially noticed during the spring and summer months that the lower cloud from the Gulf was frequently light, or absent altogether, while the upper cloud system that during the late spring usually thickens, and moves from points south of west, seemed to break up and retire.

1884.

March gave rather frequent, though light, local rains. There were some heavy thunderstorms during April and May, the last one occurring here on the 27th of the latter month; after which the only appreciable rain-fall during a period of over three months was 25-100ths from a local shower of small extent on the 7th of August.

High mid-day temperatures were the rule, especially during July, the maximum daily temperature being often 100° and over.

All the while the S. E. wind was light and more intermittent than usual, as was also the attendant cloud stratum from the Gulf.

There was, for much of the time, an entire absence of cirri or cir. st. When these clouds appeared, they invariably moved from northerly points.

During August the course of the cirri was from easterly points, the cloud moving *very slowly*. About the 30th, cirri were observed moving in large patches, or drifts, from S. W. Newspaper reports mentioned the occurrence of heavy rains, followed by westerly winds, at points due west, near the Rio Grande, during the last of August and first of September.

Heat whirlwinds were unusually frequent all summer. The day cumuli were small, scattering, and not disposed to cohere in masses.

During August, the cumuli forming out of, or succeeding the morning stratus from S. E. were seen to change in course, moving from easterly or even northerly points as they reached greater altitudes at mid-day.

After the change alluded to, near the end of August, the cirrus maintained its normal course from westerly points, with storm-clouds in sight occasionally.

At this point, however, the long drouth was not ended until the 24th of September, when there began a series of heavy thunder-showers, extending over a period of about 12 days.

Little more occurred worthy of special notice until the winter storms began, in December.

It was observable, however, that the upper cloud region seemed to be gradually filling with vapor, as shown by the increased diffusion and thickening of the cirrus and cirro-stratus, while the nascent formations of these clouds were characteristic, being projected in long unbroken lines or plumes that tended, in most cases, to rapidly spread and thicken.

The first decided "norther" of the winter began here on the morning of December 17th. The barometer tended downward during the first 12 hours of its continuance, when a heavy cloud remained, moving from S. W. The pressure was much below the mean during the last ten days of the month, with frequent oscillations. During this time a heavy bank of upper storm-clouds remained constantly about the horizon S. E., with lightning from that point at night. The upper cloud was seen to move generally from S. W., but the center of the drift was evidently several hundred miles eastward. West of this meridian the development of upper clouds was light and fragmentary.

A strong "norther" closed the year.

1885.

With the exception of a few remarkably fine days (6th to 12th, inclusive,), January was throughout unusually stormy, with strong northerly and easterly winds.

The total rainfall measured here was three inches, of which over two-thirds fell on the 4th and 20th,—on the former date during a thunder-storm, while on the night of the 19th-20th over an inch was measured, which, the temperature being about 30°, gave a coating of ice nearly an inch in thickness to all exposed objects.

It was the severest storm of the kind I have ever observed here, and much timber was broken down; there was also great suffering among animals exposed to the storm. The barometric fluctuations were remarkably frequent this month, the highest ranges being quickly succeeded by severe storms.

There was all the while a heavy current from southerly points above the N. and N. E. winds, and which controlled the highest cloud strata. This current overlapped the "norther" instead of retiring before it.

The lowest temperature was 12°, on the morning of the 17th; the highest 78°, on the 12th.

FEBRUARY.

The rain during this month was light, and not appreciable. The temperature was less spring-like than usual, especially for the last half of the month, when the north wind was remarkably persistent. The heavy upper cloud from S. W. of the preceding month was not often observable. The higher strata maintained their course from about due west, with less deflection to northerly points than usually occurs at this season.

The barometer was steadier and ranged higher than during the preceding month.

MARCH.

Throughout this month the storm changes were of a moderate type The barometer was at no time very low,and ranged generally above the mean. The lower cloud from the S. E. was often seen, and increased in density, with occasional light rain. The upper cloud from the S. W., so conspicuous in January, often appeared, was constantly augmenting, and furnished some heavy thunder-storms about the 15th.

No frost during the month, but a uniformly rather lower temperature than usual.

APRIL.

After a light "norther," the wind veered to S. E. during the 3d and 4th, while an upper cloud system developed from cir., cir. st., and cir. cu., moving from W. S. W., and thickening.

On the evening of the 4th the cir. cu. often rapidly enlarged, tending to form compact and sharply-defined cumuli and cu. st.

During the 5th a fresh S. E. wind prevailed, bearing a heavy stratus cloud, which remained unbroken, and discharged light rain at intervals all day. Thunder was heard westward about 10 A. M., and the rain soon increased to a heavy storm. The thunder-clouds were of the upper strata, and all the time wholly obscured by the heavy stratus beneath. Their course seemed from S. W. nearly. The lightning and thunder were severe and quite incessant in this vicinity from about 12 M. to 1½ P. M. Chain lightning passed to the earth at short intervals. Many trees and some houses were struck, and one person is known to have been killed.

After the 14th the barometer was, much of the time, below the mean. From the 18th to the 22d, inclusive, fresh S. E. winds prevailed most of the time, bringing a heavy Gulf cloud, at the same time the upper storm-clouds from S. W. were unusually heavy; and during this period violent thunder-storms with heavy rain were frequent, I believe, over all Western Texas.

The 22d exhibited the most active storm formation observed during the month. Local storm-centers moved from west or north-west where reactionary currents prevailed, occasionally meeting heavy storm-clouds controlled by southerly currents, thus producing a violent precipitation of rain and hail. Observation of the movements of storm-clouds near the horizon N. and E. of this point, suggests the above as explaining the origin of the very severe storms that occurred in Travis and adjoining counties on this date.

Rain was measured on seven days of the month. Total, 2 5-10 inches. The highest temperature 89°, on the 15th.

MAY.

3 85-100 in. of rain fell during this month, the same being pretty evenly distributed over 15 days. In many parts of the State the rain-fall was probably much greater, the streams here showing unusually high water throughout the month.

There was an extraordinary amount of lightning and thunder, occuring within the circle of observation almost every day and night,—particularly severe on the 17th and 28th. On each of those dates the display was uninterrupted through a period of 6 to 7 hours, in the immediate vicinity. The violent thunder-storm of the 28th was attended by a copious rain, since which the sky has cleared and the storms appear to have adjourned *sine die*.

All crops in this region are as flourishing at present as an abundant supply of moisture can make them, and occasional light showers through the summer would satisfy the needs of all. LUM WOODRUFF.

BEXAR CO., TEXAS, June 4th, 1885.

LUNAR PHENOMENON.

TO THE EDITOR:—On Saturday evening, May 30th, at 10 P. M., I noticed a very peculiar lunar phenomenon. The day preceding had been quite warm, with showers in the vicinity. The evening was cooler, but cloudy in the south and south-east, with the appearance of rain near the horizon. The moon was slightly obscured by a light haze, and, instead of the circle around the moon usually seen under such conditions, there were four luminous streamers radiating from it, or a vertical and horizontal one cutting each other at a right angle in the center of the moon Each streamer had a width equal to the moon's disc, and extended from it a distance about one-half that at which the circle is usually seen. This is a rare phenomenon, or at least rare to me, for I do not remember having seen it before; and if mention has ever been made of such an occurrence, I have never seen it. Streamers have been observed extending from the sun during an eclipse, but I have never seen any mention of any such with reference to the moon (this, however, may be due to

my limited reading in this department of science). They were all distinctly marked, and, if anything, brighter than the luminous circle usually is. Yours truly, A. J. PHINNEY.

MUNCIE, IND., June 6, 1885.

[An exactly similar phenomenon may be produced by looking at the moon through a wire or other screen with square meshes, the streamers following the direction of warp and woof.—EDITOR.]

OBSERVATIONS AT SAN JOSE, COSTA RICA.

TO THE EDITOR:—Below please find some observations on temperature, taken at San Jose, Costa Rica, Central America, by John I. De Jough, Esq., Civil Engineer, and sent by him to me. If of any interest or use to you for your journal, you can insert them; if not, consign them to the waste basket. Yours truly, etc., G. A. HYDE.

CLEVELAND, O., June 2, 1885.

1385.	January.	February.	March.	April.
Highest temperature	80°	82½°	85°	83°
Lowest temperature	58°	59°	57½°	59°
Highest daily mean	72.0°	74.2°	73.8°	74.6°
Lowest daily mean	65.0°	66.4°	67.1°	69.2°
Mean for month	68.33°	70.50	70 66°	72.25°
Mean for year	.....	.....	69.83°	70.43°

WE have an article from C. K. S., but the author has failed to send us his address. Will he kindly communicate with the Editor?

ERRATA.—In "*Temperature Diagrams*," page 169, eighth line, read *contribution* for "contributor." Page 170, fourteenth line, read *surface* for "space." Page 171, sixth line, read *attitude* for "altitude." Page 172, fourth line, for "months" read *noons*; fifth line, for "months" read *morns*.

THE GRIFFITH CLUB

MICROSCOPE

TESTIMONIALS.

The following are extracts from letters received within a few months

Roswell Park, M. D., Prof. in University of Buffalo:

The Club Microscope has safely arrived, and it is a beauty. If you ever want a written testimonial from me, it will give me pleasure to furnish it.

Prof. H. C. Griffis, Central High School, Binghampton, N. Y.:

We thoroughly believe the Griffith Club Microscope is the best.

F. L. James, M. D., Ph. D., Editor Microscopical Dep't "National Druggist," St. Louis, Mo.:

For general work, especially for students who have no fixed habitation, I think the Griffith Club perfection. The capabilities of the model are unlimited. It will do whatever any other instrument can do. Its fine adjustment is excellent and embraces features which are possessed by no other instrument, with which I am acquainted: as to finish it is superb.

Robert Aberdeen, M. D., Syracuse, N. Y.:

I received your Griffith Club Microscope day before yesterday—set it up and like it very much in every particular.

Rev. A. B. Harvey, The Author, Taunton, Mass.:

It is, indeed, an admirable instrument; the best I know of, for what you clearly meant it. A *multum in parvo* both as a home and a travelers stand.

J. T. Greenleaf, M. D., Owego. N. Y.:

The Griffith Club is a perfect stand. I don't want any better; can do any thing I want to with it.

Prof. Sarah F. Whiting, Wellesley College, Mass.:

The general plan of the stand, size, height, firmness, adjustment is perfect, and the compactness with which it can be packed, turn-table included, causes it to be without a rival.

Prof. Ada M. Kenyon, Buffalo Normal School:

My stand is like Wagner's music in that is bears the very closest acquaintence. It seems to me that for price and size there is nothing in the market that can approach it in beauty and adaptibility to work.

For circulars address,

E. H. GRIFFITH, Fairpoint, N. Y.

[From Issue of "Gems of the Northwest," by C., M. & St. P. Ry.]

The Only Pure Waukesha Water is the

WAUKESHA GLENN

THE WELL KNOWN "QUEEN OF WATERS."

Reigns alone among Natural Dietetic Table Water. Its numerous competitors appear to have, one after another, fallen away until it has no rival. The only spring in Waukesha that remains at one temperature, both summer and winter—i.e. 48°. The Waukesha Glenn Natural Mineral Water issues from a spring deeply imbedded in a rock, and is therefore of absolute organic purity.

What the Highest Authority in New York Says.

Certificate of Analysis.

Laboratory of the High School of Mines, }
Columbus College, New York, Nov. 10. }

SIR—The sample of Mineral Water from Wisconsin, marked "Glenn Mineral Spring," submitted to me for examination, contains in one U. S. gallon of 231 cubic inches:

Chloride of Sodium	1.1944 grs.
Sulphate of Potassa	0.4848 "
Sulphate of Soda	0.6212 "
Bicarbonate of Lime	15.9764 "
" of Magnesia	12.5795 "
" of Iron	0.0866 "
" of Soda	0.7594 "
Phosphate of Soda	0.0084 "
Alumina	0.0466 "
Silica	1.0497 "
Organic Matter	1.2160 "
	34.0230 grs.

This water appears to be identical with the Bethesda Water as it was before the the Glenn Spring was created by tapping the Bethesda stream.

Respectfully, your obedient servant,
C. F. CHANDLER, Ph. D.,
Professor of Analytical and Applied Chemistry.

The Waukesha Glenn Spring was created by opening a new outlet for the Bethasda stream, since which time it has caused the flow from the Bethesda Spring in dry weather to be almost exhausted, thereby rendering the Bethesda Water comparatively worthless, as shown from four analyses by Prof. C. F. Chandler, and other positive proofs.

The Glenn Mineral Water is the only diuretic water known in the world which acts directly upon the secretion of the liver, kidneys, urinary and generative organs, and is Nature's Sovereign Remedy for that numerous class of diseases that afflict the human family—and as medical statistics show us, comprise over one-half of those which terminate life.

This water will keep fresh and sweet, tasting neither stale nor flat, and is the only Mineral Water from Waukesha that will keep, which is positive evidence of its superior medicinal properties.

Waukesha Glenn Mineral Spring vs. Bethesda.

Have the curative properties of the Bethesda Spring Water depreciated, and are their original virtues found to exist to-day in the waters of the GLENN SPRING? This is the great paramount question overshadowing all others; and its solution is not to be determined by what R. Dunbar or I may say. It is not with me that these parties have their quarrel, but with science, which, through the highest chemical authority on this continent, Prof. C. F. Chandler, of the School of Mines, Columbia College, New York, declares that while the mineral solids in the Bethesda Water have fallen of fully 50 per cent. from what they were originally the organic matter has increased fully 100 per cent., and further, that the exact properties which once gave these waters their wonderful curative powers, are now found in the waters of the Glenn Spring.

Read the evidence as presented in the several analyses made of these respective waters. The original analysis of the Bethasda Water, as shown in Col. Dunbar's circular, gives:

Total Salts	35.710 grs.
Total Organic & Volatile Matter,	1.983 "
Leaving as Solid Matter	33.727 grs.

These were the constituent elements of this far-famed water that carried life, vigor and health to all that drank at this healing fountain. Have they been preserved and maintained? Let us see. The two following recent analyses of water from this same Bethesda Spring, and by this same distinguished scientist, called forth the following certificates:

Certificate of Analysis.

New York, Sept. 14.

SIR—The sample of water marked "Bethesda" (Dunbar's Spring), submitted to me for examination, contains in one U. S. gallon of 231 cubic inches:

Total Solids	21.286 grs.
Organic and Volatile Matter	3.848 "
Solid Minerals	17.438 grs.

Respectfully, your obedient servant,
C. F. CHANDLER, Ph. D.,
Professor of Analytical and Applied Chemistry. To. J. K. Glenn, Esq., N. Y.

DEAR SIR—The sample of Spring Water from Caswell, Hazard & Co., marked "Bethesda Water" (Dunbar's Spring), submitted to me for examination, contains in one U. S. gallon of 231 cubic inches:

Total Solids	21.846 grs.
Organic and Volatile Matter	4.082 "
Mineral Salts	17.764 grs.

Respectfully, your obedient servant,
C. F. CHANDLER,
Professor of Analytical and Applied Chemistry. To J. K. Glenn, Esq., N. Y.

WAUKESHA GLENN.

TESTIMONIALS.

For about two years I have been troubled with my liver, resulting in loss of flesh from my usual weight of 180 pounds down to 120, with a sure prospect of final end in a very few months—so all the doctors said. Finally I concluded to try Glenn Spring Water, that you shipped to me from the springs. For two months the effect was more than astonishing, from death (sure) to life. It was wonderful. June 1st I was able to take the road again, and have not lost a day since, getting better every month, gaining from 120 to 165 pounds. Those who saw me last winter did not expect me to live till July, and will now testify that all I say, and even more, would be true. May the Glenn Spring continue to run pure water for ever and ever. D. W. C. HOUSE,
Kansas City, Mo., Moline Plow Co.

PHILADELXHIA. August 6.

DEAR SIR—It is with great pleasure that I have to inform you of the wonderful effect the water of your springs has had upon my wife, who was unable to leave her room with chronic Bright's disease. It seemed to affect every part of her body with pain, and sleepless nights, so that the doctor gave no hopes of her; but since drinking of the Glenn Mineral Water she has not only been able to leave here bed and room, but to take long walks of one and two miles, and is fast improving in health and strength. We have now done away with all other remedies, only using the water, which keeps perfectly sweet in the manner you put it up. You will please send me at once another barrel.
Yours respectfully, JOHN RESTEIN.

48 HATHAWAY ST., CINCINNATI, April 22.

DEAR SIR—Enclosed you will find check for which you will please send me two barrels Glenn Water. I have several customers who have received substantial benefit from the use of the water, and as for myself, I think I am entirely cured of my kidney trouble, after five years' affliction. The water I bought of you last summer is just as clear and sweet now as water that I drank from your spring when I was there, while all the Bethesda Water in this market is off in color and stringy in substance.
Yours truly, THOMAS VAN NAME.

OVID, MICH., July 5.

DEAR SIR—The half barrel of mineral water I ordered for Mr. Shattwack has helped him amazingly. For several months he has had to use a catheter, but that necessity was entirely removed after using the water a few days. As regards my own case, I would say that I am about cured of Bright's disease. You will please ship me another barrel; it is for Mrs. J. Skerritt, of Victor.
Yours truly, W. HATHAWAY.

CLEVELAND, O., July 5.

DEAR SIR—Please send me one barrel of the Glenn Mineral Water to each of the following addresses. My friend, Mr. Sellers, has found so much benefit from the water I ordered for him that he tells me that he has ordered another barrel, and has just received it, and I am happy. I feel tip-top and I am a living advertisement of your excellent water. Yours truly, W. WILSON.

AMES, N. Y., August 24.

DEAR SIR—Send me another barrel of water. It is for a neighbor, Mr. B. Mount. I let him have ten gallons from my barrel, and it has helped him more than two years of treatment from the most skilled doctors of the Mohawk Valley.
Very truly, SAMUEL STEVENS.

Please send me as before one barrel Waukesha Glenn Water. The Waukesha Glenn Water is the best in the world, and my physician says, the greatest. It is deserving of all praise. GEORGE H. PEABODY,
118 East Elizabeth St., New York.

BOSTON, MASS., July 12.

DEAR SIR—Please send me five barrels of Glenn Water. Pleople here are learning the merits of Glenn Water.
Yours truly, JOHN SULLIVAN.

These, with the thousands of actual cures and benefits, ought to convince the most skeptical. The medical profession, without exception, indorse and prescribe it with the CAUTION TO AVOID the more harsh spring water, also those containng SALT in imitation of foreign waters.

THE WAUKESHA GLENN is the only specific known for the hitherto incurable diseases—Diabetes, Bright's Disease and all Kidney Affections. It has been tested by thousands whose unsolicited testimonials are open to the public, and furnished to all who desire, MAILED FREE.

Address, **T. H. BRYANT, Waukesha, Wis.**

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